REMARKS

Claims 1-20 are currently pending in the subject patent application.

In the subject Office Action, made final, claims 1-4, 6-11, 13-15, and 17-20 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sinha (U.S. Patent Number 6,889,560) in view of Lichte (U.S. Patent No. 5,303,585), since the Examiner stated that the basic limitation of claims 1, 6, 17, 18, and 19 is disclosed by Sinha in Fig. 1c and the disclosure; specifically, an apparatus for measuring liquid level in a container which comprises in combination: (a) a transducer in physical contact with the outside of a wall of the container for generating at least two acoustic resonance responses in the liquid substantially perpendicular to the surface; (b) a sweep generator for electrically exciting said transducer over a chosen range of acoustical frequencies and having a chosen waveform; and (c) a receiver for measuring the acoustic frequencies for at least two resonant responses.

The Examiner stated further that the various independent apparatus claims are mere variations of the independent claim 1, and therefore claim 1 is used to describe the claims of the present rejection. The Examiner continued that these claims contain a similar limitation that is not specifically disclosed in Sinha; that is, the transducer is located below the surface of the liquid, whereas Sinha has the transducer located above the liquid surface. The Examiner then concluded that one of ordinary skill in the art would be able to place the transducer on the bottom of the vessel to be measured because the basic principle of operation established in the art is that the transducer signals are transmitted and reflected off a surface of the liquid level to be measured, and that one skilled in the art could arrange the transmitting transducer either above or below the liquid surface without altering the operation of the device, and that therefore the mere rearrangement of the transducer location is not considered to be novel in view of Sinha.

The Examiner further asserted that Sinha does not state that a fluid through the pipe has to fill the entire pipe, and concluded that there could be a liquid/gas interface in the pipe of Sinha, but that these limitations are not specifically disclosed. Therefore, the Examiner relied upon the teachings of Lichte to meet these specific claim limitations.

The Examiner then stated that Lichte discloses a volume sensing system including electronic circuitry, which is electrically connected to an ultrasonic transducer: a transducer affixed by means of an adaptor to the base of a container having a known configuration, the container holding a liquid and a gas so that a liquid-gas boundary is formed within the container; the transducer generating ultrasonic pulses which propagate through the liquid, are reflected at the liquid-gas boundary, and are received again by the transducer, the received return pulses being converted into an electrical signal which is analyzed by the electronic circuitry to determine the level of the liquid within the container.

The Examiner next stated that both Lichte and Sinha are concerned with measuring a property of a fluid, and that the device of Lichte could operate utilizing different circuitry to control the operation and behavior of the transducer, than the circuitry utilized in Lichte utilizing the knowledge of one of ordinary skill in the art, and that the substance of the present rejection utilizes the transducer and tank arrangement of Lichte with the circuitry arrangement of Sinha to produce the system of claims 1, 6, 17, 18, and 19.

With regard to claim 13, the Examiner stated that Sinha discloses a method for measuring liquid level in a container which comprises the steps of: (a) generating at least two acoustic resonances in the liquid substantially perpendicular to the surface of the liquid; and (b) determining the frequency of at least two acoustic resonances. The Examiner concluded that these limitations are described in Sinha, although Sinha fails to disclose a method for measuring the level of a liquid having a surface in contact with a gas; however, for these limitations, the Examiner relied on the teachings of Lichte which, as is asserted by the Examiner, discloses such an arrangement.

With regard to claim 20, the Examiner stated that a method for measuring liquid level in a container which comprises the steps of: (a) generating at least two acoustic resonances in the liquid substantially parallel to the surface of the liquid; and (b) detecting the presence of acoustic resonances from the liquid, is described in Sinha, that Sinha fails to disclose a method for measuring the level of a liquid having a surface in contact with a gas, and that the Examiner has relied on the teachings of Lichte for disclosing such an arrangement.

Applicants respectfully disagree with the Examiner's rejection of claims 1-4, 6-11, 13-15, and 17-20 under 35 U.S.C. 103(a) as being unpatentable over Sinha (U.S. Patent Number 6,889,560) in view of Lichte (U.S. Patent No. 5,303,585), for the reasons to be set forth hereinbelow. Since rejected dependent claims 2-4, 7-11, 14, and 15, depend from independent claims 1, 6, and 13 which applicants believe are allowable, no further response with regard to these dependent claims is deemed necessary for this Response Under Rule 1.116.

The Examiner stated that claims 5, 12, and 16 are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Turning now to the Examiner's use of the Sinha reference, applicants wish to point out that Sinha teaches launching acoustic waves perpendicular to the walls of a pipe completely filled with the liquid under investigation. See, for example, Col. 6, lines 28-40, wherein it is stated that: "The intensity transmission coefficient, T, for the case of a single fluid layer having path-length, L, ... between two identical wall boundaries can be expressed as ... ." (emphasis added by applicants). In addition, Col. 6, lines 50-53, states that: "The digitized data of two resonance peaks can then be used to extract the sound speed since the liquid path length (the diameter of the pipe) is known." (emphasis added by applicants). Further, in Col. 8, lines 36-40, it is stated that: "In this case, it is not necessary to determine the frequency spacing between any two consecutive peaks because the resonance spectrum is determined by the path length (pipe or tube diameter) and the sound speed of the liquid." (emphasis added by applicants). Moreover, in Col. 9, lines 58-64, it is stated that: "It is believed by the present inventor that the frequency shift is due to a slight variation in the acoustical properties of the fluid due to the flow boundary layer formed adjacent to the inner surface of the wall. This boundary layer tends to introduce a phase shift of the sound waves reflecting from the wall which can affect the standing-wave pattern formed inside the total fluid path length." (emphasis added by applicants). This last statement in Sinha points out that the inner surface of the wall is a continuous entity.

Thus, applicants respectfully disagree with the Examiner's statement in the subject Office Action that Sinha does not state that a fluid through the pipe has to fill the entire pipe, and that there could be a liquid/gas interface in the pipe of Sinha, although these limitations are not specifically disclosed. Nor would it be obvious from the teachings of Sinha that an acoustic resonant cavity could be formed in a liquid between the surface of a liquid having a gas interface and a metal wall below this surface.

In view of the foregoing, applicants believe that Sinha teaches that the fluid under investigation is in contact with the walls of the pipe between which a resonance response is generated. By contrast, subject claim 13 recites generating at least two acoustic resonances in the liquid substantially perpendicular to the surface of the liquid, wherein the surface forms an interface with a gas. Similar recitations may be found in independent claims 1, 6, and 17-20; for example, claim 1 recites: "... a transducer in physical contact with the outside of a wall of the container located below the surface of the liquid for generating at least two acoustic resonance responses in the liquid substantially perpendicular to the surface; ... ."

That the acoustic resonances are generated between the surface of the liquid and a wall of the container located below the surface thereof and upon which a transducer is mounted, is also explained on page 11, lines 15-19 of the present Specification, as originally filed, wherein it is stated that: "When no liquid is present, sound propagates through the air (or vapor above a liquid surface) with difficulty because of the very high acoustic impedance mismatch between the solid wall and the gas. In principle, however, it is possible to observe resonances generated in the gas, but such signal levels are orders of magnitude smaller than those generated in a liquid when a liquid is present." Additionally, on page 5, lines 21-25, of the present Specification, as originally filed, it is stated that: "Turning now to the drawings, FIG. 1 is a schematic representation of one embodiment of the apparatus of the present invention where standing waves are generated in an acoustic cavity formed by the surface of the liquid acting as a reflector and a transducer for introducing vibrational energy into the liquid external to and through a wall of the container holding the liquid." Thus, the resonances observed by the present inventors derive from a very different phenomenon in the present claimed invention from that of the Sinha reference.

Applicants also respectfully disagree with the Examiner's statement in the subject Office Action that: "The Sinha reference has the transducer located above the liquid surface, however, one of ordinary skill in the art would be able to simply place the transducer on the bottom of the vessel to be measured because the basic principle for operation established in the art is that the transducer signals are transmitted and reflected off a surface of the liquid level to be measured.", in that Sinha does not teach reflection off a surface of the liquid level to be measured. Rather, as described hereinabove, Sinha requires that the reflection is from the wall of the tube.

Concerning claims 17-20, applicants wish to point out that the acoustic resonances are generated parallel to the surface of the liquid. Nowhere in Sinha are resonances described that are generated parallel to the surface of the liquid under investigation.

Thus, applicants respectfully believe that Sinha both teaches away from Lichte and from the present claimed invention, and that the Examiner has improperly combined Sinha with Lichte. Therefore, the Examiner has failed to make a *prima facie* case for obviousness as is required for a rejection under 35 U.S.C. 103(a).

In view of the discussion presented hereinabove, applicants believe that subject claims 1-20 are in condition for allowance or appeal, the former action by the Examiner being earnestly solicited at an early date.

Reexamination and reconsideration are respectfully requested.

Respectfully submitted,

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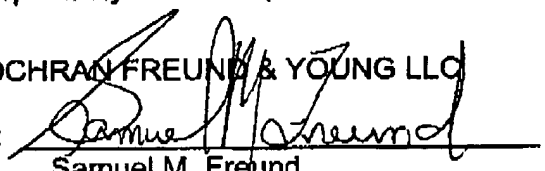
Date: June 12, 2006

By: 

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